Mandarin Selection Trials in Arizona – 2008-09[1]

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Abstract

Fifth year yield and packout data from a trial containing 'Fina', 'Fina Sodea', 'Sidi Aissa', 'Oroval', 'W. Murcott Afourer', 'Fremont', and 'Gold Nugget; selections were collected in 2008-09. For the year, 'W. Murcott Afourer' had the greatest yield, 'Gold Nugget' and 'W. Murcott Afourer' had the largest fruit size, while 'Fremont' had the smallest yield and the smallest fruit size.

Introduction

Mandarins are becoming increasingly important to the US citrus industry. Mandarins are seen by the consumer as good to eat and convenient, because of their flavor, seedlessness and ease of peeling. All three of these characteristics must be exhibited by a successful mandarin cultivar. The clementine is the cultivar that has been most popular because of these characteristics. Spanish imported Clementines that used to appear on grocery shelves are being replaced by California-grown fruit. The objective of this study is to test the adaptability of Clementines and other mandarins to the Arizona conditions.

Materials and Methods

This trial was established in March 2003 in Block 21 of the Citrus Agricultural Center, near Waddell, Arizona. Trees were planted on a 24-ft x 24-ft spacing. Mandarin selections in the trial include:

- 'Fina' – The original clementine cultivar imported from Algeria into Spain in 1925. Reportedly late, with small fruit. The standard selection for the region.
- 'Fina Sodea' – A mutation of Fina clementine discovered in Morocco.
- 'Fremont' – A variety developed at the USDA station at Indio, CA. This variety is a clementine x Ponkan mandarin hybrid and is mid-season and sweet.
- 'Gold Nugget' - A seedless mid- to late-season mandarin developed at the University of California, Riverside. 'Gold Nugget' is a hybrid of 'Wilking' x 'Kincy' parentage.
- 'Oroval' – A spontaneous mutation of Fina, discovered in 1950.
- 'Sidi Aissa' – Another mutation of Fina clementine discovered in Morocco. Valued there because of its large fruit size and durable peel.
- 'W. Murcott Afourer' ('W. Murcott') – An easy peeling mandarin, probably a tangor, that originated as an open-pollinated seedling in Morocco. Seedless when grown in isolated blocks.

The original plan was for there to be 15 trees of each variety. However due to mistakes while the trees were propagated and subsequent tree death, there range between 10 and 21 trees of each variety, except for 'W. Murcott Afourer' with 6 trees, and 'Gold' Nugget' with 4. All trees are on Carrizo citrange rootstock.

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Irrigation is border flood, and normal cultural practices are used. Yield data is collected during the winter, and 2004-05 was the first harvest year for this trial. For 2008-09, trees were strip-picked on 12-30-08, except the 'W. Murcott Afourer' and the 'Gold Nugget' which was picked on 1-15-09. For each harvest date, 70 to 80 lbs of harvested fruit from each tree was passed through an automated electronic eye sorter (Autoline, Inc., Reedley, CA), which provides weight, color, exterior quality (blemish) and size data for each fruit. Fruit packout data is reported on a percentage basis. Ten fruit per tree were selected for fruit quality analysis. This analysis included % juice, juice pH, total solids, total acids, total solid to total acid ratio, and peel thickness.

All data was analyzed using SPSS 11.0 for Windows (SPSS Inc., Chicago, Illinois).

Results and Discussion

Fifth year yield for the trial is shown in Figure 1. Among the clementines, 'Fina' had the greatest yield, with just over 250 lbs. per tree. 'Oroval' and 'Sidi Aissa' had 95 and 87% of the yield of 'Fina', but this was not significantly less. 'Fina Sodea' was the only clementine with significantly less yield than 'Fina'; producing less than 200 lbs. of fruit per tree, or only 75% of the yield of 'Fina'. Among the other selections included in the trial, 'Fremont' had the least yield; about 180 lbs. per tree, only 71% of the yield of 'Fina'. 'W. Murcott Afourer' and 'Gold Nugget' had greater, but not significantly greater yields than 'Fina', producing 301 and 273 lbs. of fruit per tree, or 7 and 18% more respectively than 'Fina'.

Yields since the initiation of the experiment are shown in Figure 2. The 2008-09 harvest season represented the greatest increase in yield for all the selections, except for 'Fremont'. For the clementines, yield increases over the previous year ranged from 21% for 'Fina Sodea' to 68% for 'Fina'. After a 33% decrease from 2006-07 to 2007-08 yield for 'W. Murcott Afourer' increased by almost 300%. The 2008-09 harvest season was the first time that yield of 'W. Murcott Afourer' surpassed all the other selections. Yield for 'Gold Nugget' increased by 566% from 2007-08 to 2008-09; 2008-09 was the first year in which yield from this selection was not the least of all the selections under trial.

Packout of the cultivars is shown in Figure 3. 'W. Murcott Afourer' and 'Gold Nugget' had significantly larger fruit; 'Gold Nugget peaked on sizes 125 and 150, while 'W Murcott Afourer' peaked on sizes 150 and 180. The four clementine selections had the next largest fruit, peaking on sizes 180 and 210. Of the four clementines, 'Sidi Aissa' was the smallest, while 'Oroval' was slightly larger. 'Fremont' had the significantly smaller fruit of the seven selections tested, peaking on size 210.

'Fina' fruit had significantly higher juice content, lower pH, and higher total soluble solids (TSS) and lower total acids (TA), compared to the other clementine selections (Table 1). This may be due to less granulation found in this selection. We did not specifically measure granulation in 2008-09 but this was also the case when we measured granulation in 2007-08. Among the clementines, 'Oroval' had the lowest juice content, and a somewhat higher pH level, while the interior fruit quality of 'Fina Sodea' and 'Sidi Aissa' were intermediate. 'W. Murcott' and 'Gold Nugget' had juice contents that were neither the highest nor the lowest among the selections tested. 'W. Murcott' had the one of the greatest pH levels, and a comparatively greater level of total soluble solids and acids, while 'Gold Nugget' had the lowest pH level, but the greatest level of TSS and TA. There was no significant difference in TSS:TA between any of the selections.

Although there were significant differences, all the selections had peel thicknesses between 2.3 and 3.4 mm, with the smaller-fruited 'Fremont' having the thinnest peel, and 'Gold Nugget' having significantly thicker peel (Table 2). 'Gold Nugget' had the roundest fruit, while fruit of 'W. Murcott Afourer' was the most flattened. 'Fremont' had the reddest color fruit, color of the four clementine selections was slightly less red, while color of the late ripening 'W. Murcott Afourer' and the 'Gold Nugget' selections were the least red. There was no significant difference in exterior quality among the selections tested.

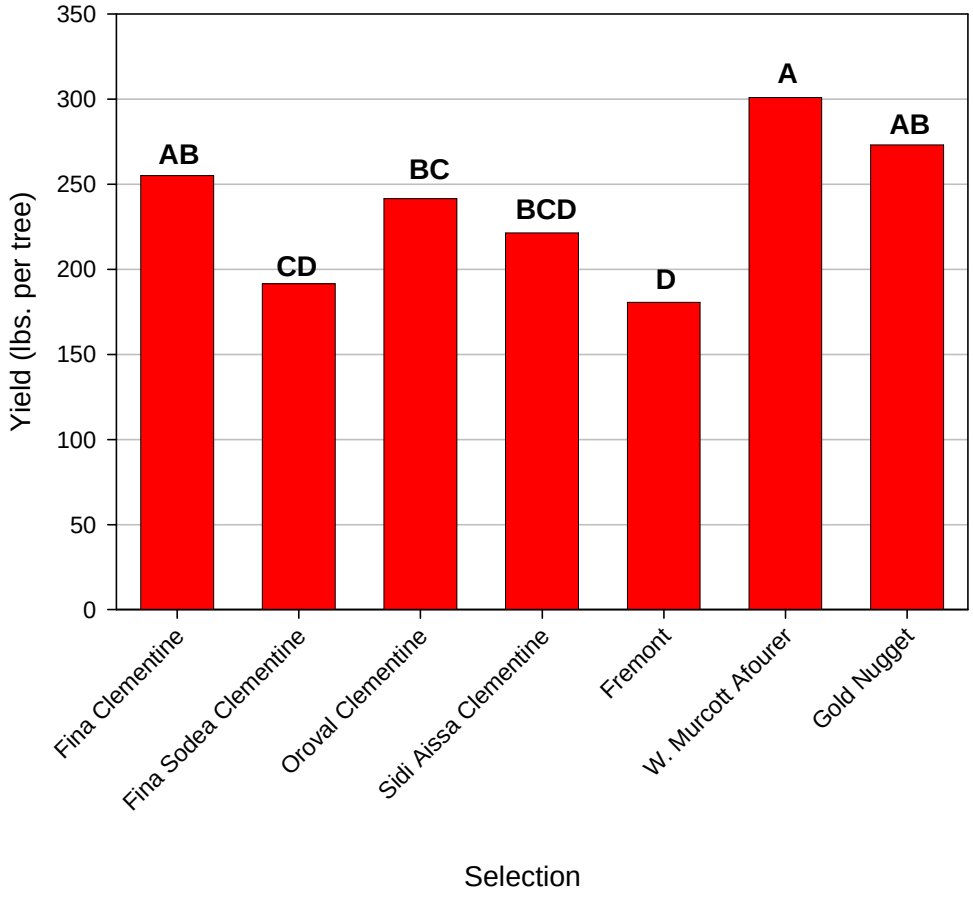

Figure 1. Yields of five mandarin selections on Carrizo citrange rootstock for 2008-09 season. Overall yield for the year can be compared using the uppercase letters above each stacked bar.

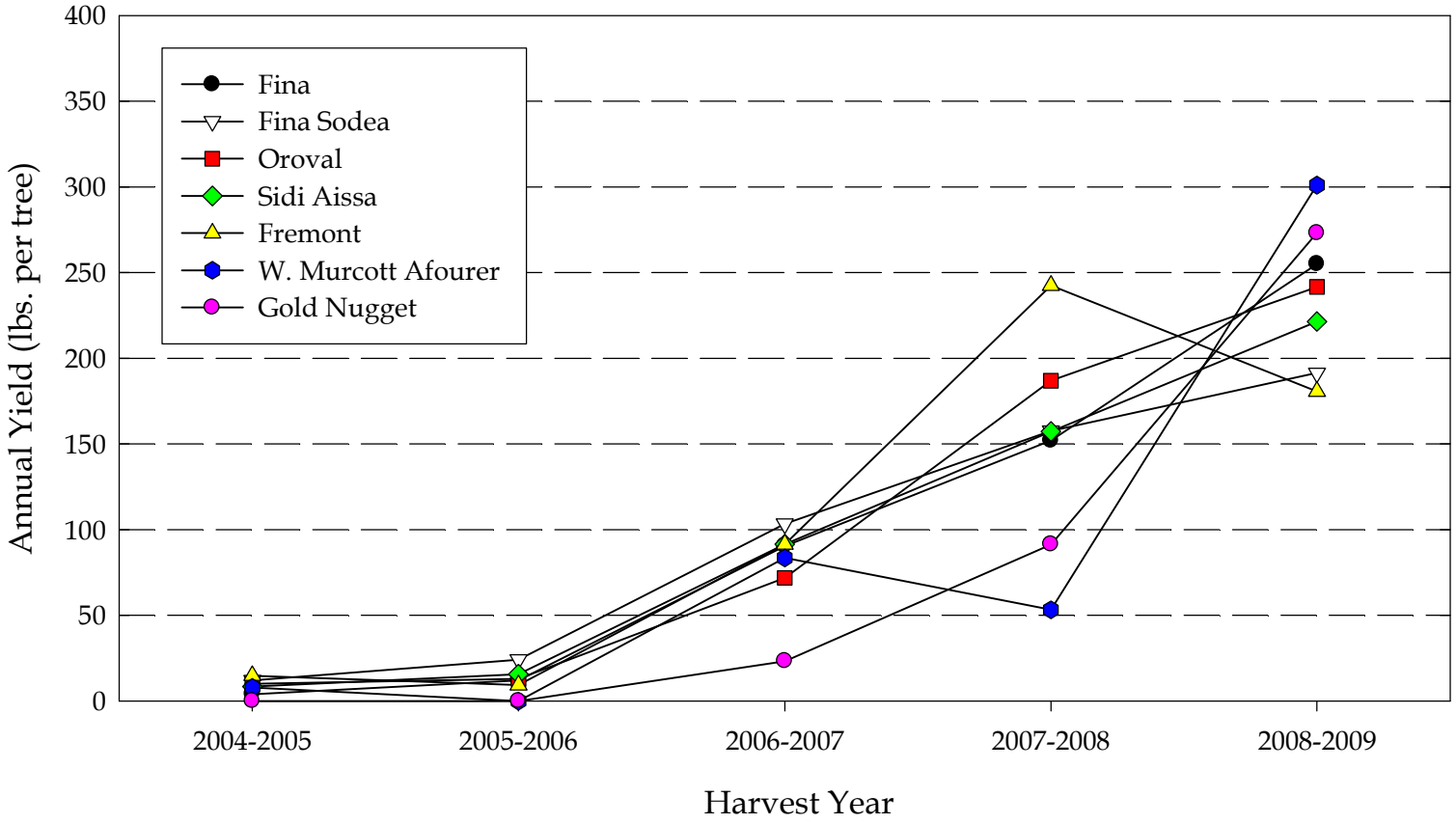

Figure 2. Annual mandarin yields for the 2004-05 through 2008-09 growing years.

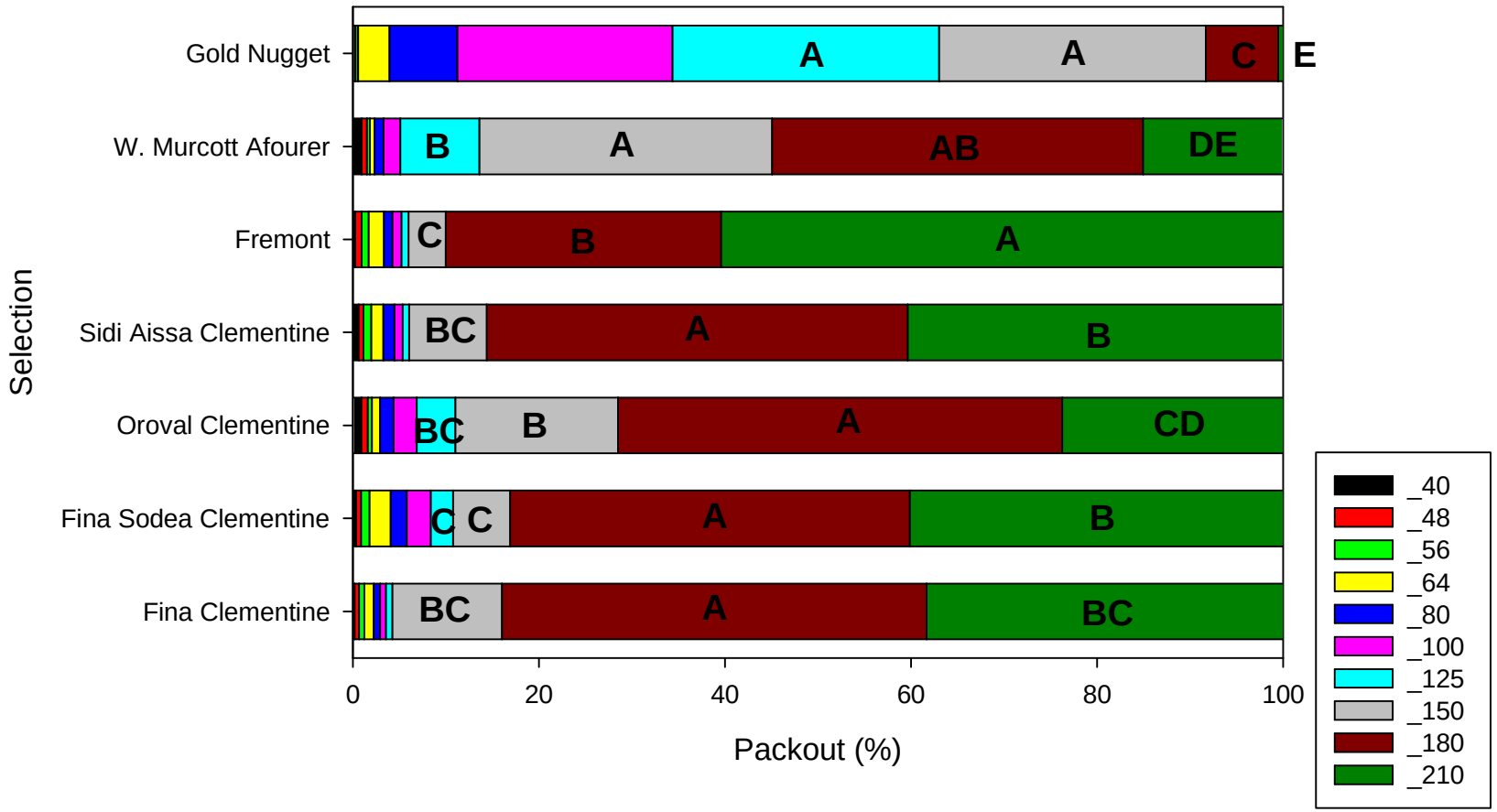

Figure 3. Packout of seven mandarin selections on Carrizo citrange rootstock for the 2008-09 season.

Table 1. 2008-09 Fruit quality of six mandarin cultivars budded to Carrizo rootstock.

Cultivar	Juice Content (%)	pH	Total Soluble Solids (TSS) (%)	Total Acids (TA) (%)	TSS:TA
Fina	48.13 a[z]	3.42 bc	12.21 bc	1.10 a	11.23 a
Fina Sodea	33.98 bc	3.59 a	10.79 d	0.86 b	12.81 a
Oroval	32.67 c	3.55 ab	11.07 cd	0.95 b	11.99 a
Sidi Aissa	37.99 bc	3.60 a	11.04 cd	0.84 b	13.19 a
Fremont	33.73 bc	3.60 a	11.06 cd	0.86 b	13.05 a
W. Murcott Afourer	39.53 b	3.48 abc	12.93 ab	1.11 a	12.05 a
Gold Nugget	34.40 bc	3.39 c	13.55 a	1.21 a	11.61 a

[z] Means separation in columns by Duncan's Multiple Range Test, 5% level.

Table 2. 2008-09 additional fruit quality parameters of six mandarin cultivars budded to Carrizo rootstock.

Cultivar	Peel Thickness (mm)	Fruit Shape[y]	R/G[x]
Fina	2.31 b[z]	0.937 a	2.72 bc
Fina Sodea	2.73 b	0.937 a	2.77 b
Oroval	2.67 b	0.941 a	2.63 c
Sidi Aissa	2.63 b	0.935 ab	2.66 c
Fremont	2.56 b	0.928 b	3.31 a
W. Murcott Afourer	2.47 b	0.902 c	2.40 d
Gold Nugget	3.43 a	0.940a	1.94 e

[z] Means separation in columns by Duncan's Multiple Range Test, 5% level.

[y] A value of 1.00 signifies a completely round fruit. Values greater than one signify increasingly flattened fruit.

[x] Signifies the red to green intensity ratio of the fruit. A greater value signifies more orange or red color.